Potato Fertilization and Internal B

fertilization studies show potash deficiency to be closely linked with the incidence of internal disorder of potatoes

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The potato defect—internal black spot—involving the variety Netted Gem in the Santa Maria Valley is of considerable economic importance.

Preliminary studies showed the Santa Maria trouble to be identical to potato black spot known to be in Europe and in many potato producing areas in the United States.

Samples Classified

In fertilizer field tests, tuber black spot records were made of samples taken at approximately 15-day intervals, starting at 70 days after planting and continuing up to harvest. The samples included tubers hand dug which—with no subsequent handling—never showed any discoloration, tubers examined after machine digging, and machine-dug tubers examined after being subjected to heavy artificial bruising in a rotating drum.

Black spot found in the samples was recorded both as per cent of tubers affected and as bruising index to express the severity of disease. Tubers were classified as 0, for no black spot; 1, for mild; 2, for moderate; and 3, for severe discoloration. A bruising index of 1.50 for a sample meant that the average tuber in that treatment had a degree of black spot intermediate between mild and moderate. A bruising index of 0.50 or over from a field—following artificial bruising—quite likely indicated that a considerable per cent of the tubers were severely affected and that the field might represent a potential loss to the grower.

Field Tests and Survey

Results of studies on six test fields and 25 fields in a nutrient survey indicated that neither nitrogen nor phosphorus fertilization had any effect upon the occurrence or development of internal black spot after artificial bruising. Black spot did not occur unless the potatoes were handled and the incidence increased

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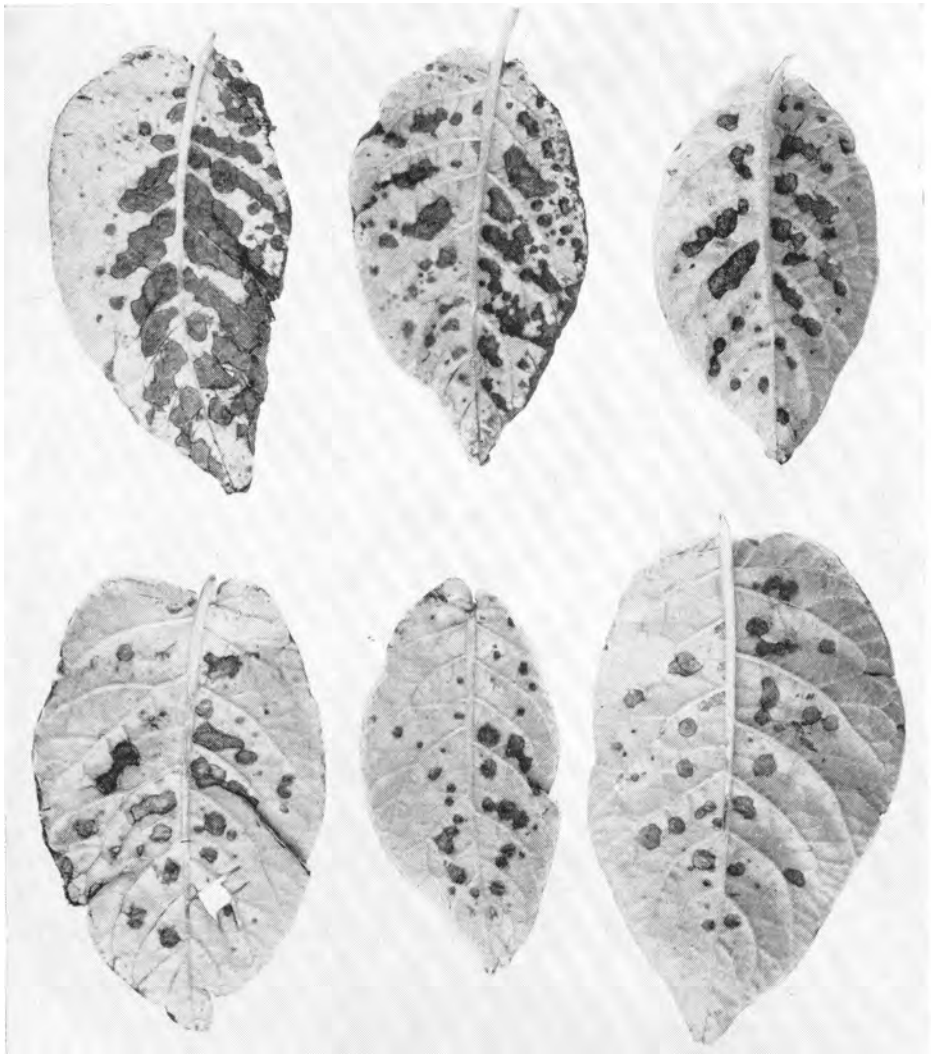
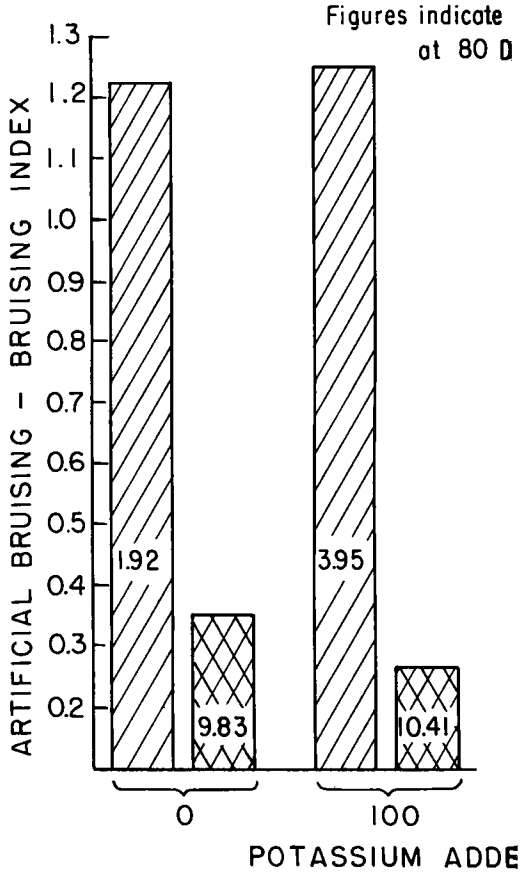
Potassium deficiency symptoms in potato leaves of Netted Gem variety from Santa Maria Valley.



Potash levels in potato vines as correlated Three potash-deficient fields are compared



POTATO

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yields were obtained from applications of 200 pounds per acre or more of potash than from only 100 pounds. In that same field, the yield was practically doubled by applying 100 pounds per acre of potash as compared to none. An average of all fields showed plots without potash to yield 301 sacks per acre as compared to 345 sacks in plots receiving 100 pounds per acre of potash, 362 sacks with 200 pounds, and 373 sacks with 400 pounds per acre. Potash deficiency symptoms were commonly observed on plants grown on plots not receiving potash and were characterized by leaf scorch, bronzing, and spotting on the leaves and by small necrotic areas on the stems and at the nodes.

In the field experiments, it was determined that potassium levels in the petiole tissue of about 10% at 50 days after planting, 8% at 65 days after planting and 6% at 80 days after planting approached the deficiency levels. Potassium contents of the petiole tissue much below those levels were associated with reduced yields and deficiency symptoms in the foliage. On the basis of these levels, over half of the samples from growers' fields were deficient in potash and it is probable that yields could have been noticeably increased by higher rates of potash application.

Fertilizer Treatments and Total Yields of Potatoes
Six fertilizer experiments in the Santa Maria Valley

Fertilizer treatment Nitrogen-Phosphorus pentoxide-Potassium oxide (Pounds/acre)	Cwt. per acre						
	Fields						Average 6 fields
	1	2	3	4	5	6	
0–100–100	244	270	253	356	265	248	273
60–100–100	314	398	310	387	297	334	340
120–100–100	266	461	337	360	281	366	345
180–100–100	305	517	356	367	296	362	367
120– 0–100	331	483	343	379	270	366	362
120–100– 0	149	403	289	356	282	327	301
120–100–200	339	467	341	367	284	371	362
120–100–400	361	475	368	364	310	357	373
120–100–600	331	494	365	376	313	356	373
LSD[1] 5% level	58	43	33	NSD[2]	NSD	38	

[1] Least significant difference.
[2] No significant difference.

Forrest Fullmer of the American Potash Institute assisted in the above studies.

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BLACK SPOT

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with the amount of handling. Discoloration was mild in tubers that had been handled only to the extent of machine digging as compared to those that had been artificially bruised. The defect did not develop following handling of potatoes from plants that were only 70–75 days old but tubers became increasingly susceptible as the plants matured.

Responses to Potash

In three of the test fields—fields *1*, *2*, *3*—black spot was a severe problem. Those fields exhibited potassium deficiency symptoms in the vines, showed significant yield responses to potash, and showed low percentages—under 6% at 80 days following planting—of potassium in the vines.

In fields *4* and *5* potash was sufficient as indicated by absence of symptoms, no yield response, and high—over 9.5% potassium at 80 days—potash levels in the vines. Black spot was of no consequence in either of those fields. Bruising index was under 0.4 in both.

Field *6* was intermediate in potash requirement and its tuber progeny showed an intermediate severity of black spot.

In the three potash-deficient fields—*1*, *2*, *3*—the addition of potash up to 600 pounds per acre significantly reduced black spot severity but not enough to approach a field control. Six hundred pounds potash per acre raised the potassium levels in the 80-day-old plants to an average of 7.22% in those fields.

In the 25 fields included in a nutrient survey, black spot was consistently more severe in the tubers from fields in which potash content—as revealed by petiole analysis—was low. On those fields in which the bruising index of tubers was invariably 0.50 or less at harvest the petiole tissue analyzed 9%–10% potassium at approximately 80 days.

Internal black spot of potatoes is in some way linked to the potassium nutrition of the crop, but was not corrected in the Santa Maria tests by applications of potash up to 600 pounds per acre. Although maximum yields and normal appearing vines were associated with potassium levels in the petiole tissues of about 6% at 80 days after planting, black spot was mild or absent only where potassium levels were about 10% at this stage of growth.

Severity of Internal Black Spot of Potatoes on Test Fields in the Santa Maria Valley

Fertilizer treatment Nitrogen-Phosphorus pentoxide-Potassium oxide (Pounds/acre)	Bruising Index						
	Fields						Average 6 fields
	1	2	3	4	5	6	
0–100–100	1.03[1]	0.98	1.14	0.24	0.47	0.31	0.70
60–100–100	1.06	1.47	1.44	0.20	0.39	0.39	0.83
120–100–100	0.95	1.43	1.40	0.17	0.41	0.37	0.79
180–100–100	0.94	1.94	1.42	0.26	0.25	0.49	0.88
120– 0–100	0.61	1.83	1.30	0.23	0.28	0.36	0.77
120–100– 0	0.94	1.50	1.21	0.33	0.37	0.74	0.85
120–100–200	0.77	1.34	1.31	0.57	0.24	0.53	0.79
120–100–400	0.72	1.44	1.14	0.14	0.36	0.47	0.71
120–100–600	0.71	1.25	1.22	0.18	0.20	0.28	0.64
LSD[2]—5% level	NSD[3]	0.41	NSD	NSD	NSD	0.21	0.16
LSD —1% level							0.21

[1] Bruising index indicates the average severity of black spot in the tubers (1 = mild; 2 = moderate; 3 = severe). An index of 1.03 means that the average degree of black spot of all tubers was slightly more than mild. An index of approximately 0.50 or over represents an economic amount of disease.
[2] Least significant difference.
[3] No significant difference.

Forrest Fullmer of the American Potash Institute assisted in the above studies.

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